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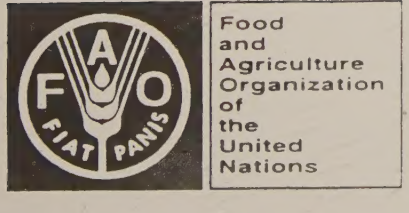
LIST OF ANIMAL SPECIES USED IN AQUACULTURE



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LIST OF ANIMAL SPECIES USED IN AQUACULTURE

prepared by

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1996

PREPARATION OF THIS DOCUMENT

With the contribution of aquaculture to world food fish and shellfish supply steadily increasing (FAO, 1995a) and the mass of information available on the different species cultured increasing dramatically, the FAO Inland Water Resources and Aquaculture Service of the Fisheries Department identified the need to gather accurate information on the most important species cultured worldwide. This list represents the first step toward a more complete publication which will eventually include information on taxonomy, biological characteristics, culture techniques, reproduction, feeding, diseases, natural range and habitat, regions where farmed and aquaculture status for the most important species cultured worldwide.

The starting point to prepare such a list was clearly identified in the Aquaculture Production Statistics prepared for every year since 1984 by the FAO, Fishery Information, Data and Statistics Service. After a screening of the aquaculture literature it was evident that there are other species which for different reasons are still not reported by Member Countries to FAO but which already make an important contribution to world aquaculture production. To extract these species from the enormous amount of papers published in the recent years on aquaculture matters, an essential tool has been the Aquatic Sciences and Fisheries Abstracts (ASFA, 1993 and 1996, consulted through the CD-ROM versions) which also allowed the quantification of the importance of the species through counting the number of papers dedicated for each species. After this initial screening, many other sources were consulted and these are listed in the References section which includes about 120 records.

During the consultation of papers and books dealing with aquaculture species, it was evident to the Author that often some confusion is generated by the incorrect use of scientific and vernacular names. For this reason, each section of the list regarding the three major animal groups (fishes, crustaceans and molluscs) is accompanied by notes which try, without any pretension to be definitive, to clarify the information on scientific names, common names, environment, production and geographical distribution of the various species every time this has been found inconsistent between different sources.

ACKNOWLEDGEMENTS

Dr. Robin L. Welcomme, Chief, FAO Inland Water Resources and Aquaculture Service, who first proposed to prepare this list;

Dr. Devin Bartley and Dr. Albert G.J. Tacon, Fishery Resource Officers, FAO Inland Water Resources and Aquaculture Service, who supervised the work, provided useful suggestions and assisted with the editing of the manuscript.

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ABSTRACT

A total of 262 fish, crustacean and mollusc species, representing the most important animals used in aquaculture worldwide are listed. This list has been derived primarily from those reported by Member Countries to FAO in the aquaculture production statistics with the addition of other species reported in other sources as being important. For each one of the listed species, family, scientific name, common name, environment, total production as reported by FAO, geographical distribution and production by continent are given. Under geographical distribution, the list distinguishes between native or introduced species. Each list of the major animal group is completed by notes providing information on inconsistencies which have been found between the different sources consulted during the preparation of the list.

All data are summarized in a final table. Asia, which produces about 85% of world aquaculture production, is the continent where introduced species have less importance. Instead, introduced species form the major part of crustacean production in Europe and fish production in South America and Oceania. A very limited number of species (31) account for 95% of the total production reported to FAO at the species level. Eleven of these species belong to the Cyprinidae. The number of species reported to FAO has increased in the last eleven years but not as much as would be expected as an outcome of the effort of researchers and farmers in experimenting with new species suitable to aquaculture.

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1. INTRODUCTION

The number of animal species suitable for aquaculture is steadily increasing worldwide. As new techniques for artificial breeding, rearing and feeding are developed, many species previously only available through capture fisheries are now under culture or experimentation. Notwithstanding this effort of researchers and farmers, most of the world aquaculture production is based on a relatively limited number of species.

According to the latest official aquaculture production statistics (FAO, 1996), production data for 103 fish species, 21 crustacean species and 43 mollusc species were reported for 1994. These 167 species accounted for 15,369,861 metric tons of production, or 82.8% of the total aquaculture production (18,555,115 mt) reported to FAO for the three major animal groups. The other 3,185,254 mt of production (17.1% of the total) were not identified to species and were reported by member countries to FAO using genus, family or less specific taxonomic levels. Other animal resources, such as frogs, turtles, crocodiles and alligators, sea-squirts and tunicates, and sponges, have not been included in this list because production data at the species level have been reported to FAO (1996) only for one species (*Chelonia mydas*). Species cultivated only for larval feeding, such as *Artemia salina*, have not been included.

Other species, selected from recent literature (consulted through ASFA, 1996) and literature reviews (see References) or from previous lists (Pillay, 1990), have been added to those reported in FAO (1996), resulting in a total number of 262 species including 151 fish species, 39 crustacean species and 72 mollusc species. Although Pullin (1996) puts the number of fish species used in aquaculture slightly higher at 178, only species cultured commercially and with a relevant production in some country have been considered here, thus excluding species under experimentation and those animal produced by inter-species hybridization.

The purposes of this preliminary list of aquaculture species are: i) to document, to the extent possible, the number of animal species currently cultured by region and worldwide; ii) to facilitate communication of accurate information on species names and production, and iii) to assess contribution of introduced species to aquaculture production.

Since this list is provisional it is hoped that this Circular will provoke comments and suggestions from researchers and farmers alike. Persons finding mistakes or omissions are kindly requested to send comments to:

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2. STRUCTURE OF THE LIST

The information provided for each species includes: family, scientific name, common name, environment, total production as reported by FAO (1996), geographical distribution and production by continent. The species are listed, inside each group, by the phylogenetic order of the families (Eschmeyer,1990, for fish classification; Bowman and Abele, 1982, for crustacean classification; Turgeon *et al.*, 1988, for mollusc classification) and in alphabetical order inside each family.

In some cases, the scientific names listed with production data in FAO (1996) have been amended to conform to recent taxonomic revisions. Difficulties in species classification and lack of specificity in the data supplied by Members Countries are limitations in the quality of aquaculture statistics and need improvement (FAO, 1995b). Scientific names, common names, data production and geographical distribution needing explanations are marked with an asterisk (*). Additional information is given for each * entry in the Notes paragraphs following the list of each major group.

In the Common name column, the FAO English name (FAO 1994a, 1995c, 1996) for each species is listed; if it does not exist, other sources (CEC, 1993; Robins *et al.*, 1991a,b; Turgeon *et al.*, 1988; Williams *et al.*, 1988) have been utilized. In a few cases, if an English name is missing or is rarely used because the species is mainly cultivated in non-English speaking countries, the common name in the local language has been listed (e.g., cachama blanca, Spanish and commonly used name for *Piaractus brachypomus*).

Environmental information is restricted to the salinity level of the water, divided into three categories: FreshWater, Brackish Water and Salt Water. Either the complete life cycle or successful adaptation trials have been taken in account to categorize the species. For example, anadromous and catadromous species belong to all the three categories and species such as *Dicentrarchus labrax* (European seabass), a eurhyhaline marine species which also lives in brackish water but which, as demonstrated in experimental aquaculture trials (Cataudella *et al.*, 1991), can be reared also in freshwater, is also classified as a freshwater species.

For the geographical distribution by continent, the division by major fishing areas used in the FAO Yearbook of Fishery Statistics (1995c) for inland waters has been followed (Figure 1). North America is extended down to Panama and includes also the Caribbean countries. Marine species have been considered to be distributed in the continents which coasts lie along the oceans where the species are found (e.g., a species found in the entire Mediterranean and Black Sea is considered as present in Africa, Asia, Europe and Former USSR).

In light of the fact that the use of introduced species has significantly contributed to aquaculture production, as they have in terrestrial-based agriculture, and because aquaculture was the primary motivation for the introduction of exotic species into inland waters (Welcomme, 1988), the list designates species as native (N) or introduced (I), in regards to the continent where they are cultured. Note that

when a species is listed as native (N) to a continent it should not be interpreted as being native to the entire continent. Information about introductions have been mainly taken from Welcomme (1988) and Courtenay *et al.* (1991) for fishes, Lee and Wickins (1992) for crustaceans, and from several sources for molluscs (Carlton, 1992; Moyle, 1991; Utting and Spencer, 1992).

Figure 1. World division by continent used for species geographical distribution

3. FISHES

3.1 LIST OF FISH SPECIES

N = Native I = Introduced

Family	Scientific name	Common name	Environment			Production	Production by continent for native and introduced species															
							Africa		America North		America South		Asia		Europe		Oceania		Former USSR	
			FW	BW	SW	1994 (mt)														
ACIPENSERIDAE	*Acipenser baeri*	Siberian sturgeon	X	X										I		I				N
	Acipenser ruthenus	Sterlet sturgeon	X	X												N				N
	Acipenser stellatus	Starry sturgeon	X	X	X									N		N				N
	Acipenser transmontanus	White sturgeon	X	X	X					N						I				
	Huso huso	Beluga	X	X	X									N		N				N
OSTEOGLOSSIDAE	*Arapaima gigas*	Arapaima	X							I		N								
	Heterotis niloticus	African bonytongue	X			*		N												
ANGUILLIDAE	*Anguilla anguilla*	European eel	X	X	X	8,214	282	N		I		I		I	7,932	N				
	Anguilla japonica	Japanese eel	X	X	X	39,304						I	39,304	N		I				
	Anguilla rostrata	American eel	X	X	X	49			49	N										
CHANIDAE	*Chanos chanos*	Milkfish	X	X	X	400,945		N		N			400,919	N			26	N		
CYPRINIDAE	*Abramis brama*	Freshwater bream	X	X		180								N*	111	N			69	N
	Aspius aspius	Asp	X	X		*								N*		N				N
	*Catla catla**	Catla	X			361,394		I					361,394	N						I
	Carassius auratus	Goldfish	X			565	5	I		I		I	117	N	1	N	2	I	440	N
	Carassius carassius	Crucian carp	X			389,377	1	I				I	389,326	I	50	N				N
	*Cirrhinus molitorella**	Mud carp	X			100,068				I			100,068	N						
	Cirrhinus mrigala	Mrigal carp	X			353,952		I					353,952	N						I
	Ctenopharyngodon idellus	Grass carp	X			1,819,447		I	39	I		I	1,817,961	N	866	I		I	581	N
	Cyprinus carpio	Common carp	X			1,526,558	7,016	I	7,939	I	218	I	1,345,559	N	77,480	N	10	I	88,336	N
	Hypophthalmichthys molitrix	Silver carp	X			2,210,170		I	6,867	I		I	2,168,351	N	2,786	I		I	32,166	N
	*Hypophthalmichthys nobilis**	Bighead carp	X			1,072,461		I*		I			1,068,906	N	645	I			2910	I
	Labeo calbasu	Orangefin labeo	X											N						
	Labeo rohita	Roho labeo	X			440,268		I					440,268	N						I
	Leptobarbus hoeveni	Hoven's carp	X			704							704	N						

							Production by continent for native and introduced species																	
Family	Scientific name	Common name	Environment			Production	Africa		America North		America South		Asia		Europe		Oceania		Former USSR					
			FW	BW	SW	1994 (mt)																		
	Megalobrama amblycephala	Wuchang bream	X											N										
	Mylopharyngodon piceus	Black carp	X			105,007		I*		I			105,007	N		I								
	Notemigonus crysoleucas	Golden shiner	X			9,847			9,847	N														
	Osteochilus hasselti	Nilem carp	X			12,600							12,600	N										
	Parabramis pekinensis	White amur bream	X			281,625							281,625	N										
	Puntius gonionotus	Thai silver barb	X			28,528							28,528	N										
	Puntius javanicus	Java barb	X			22,100							22,100	N										
	Rutilus rutilus	Roach	X			*										N								I
	Tinca tinca	Tench	X			839		I		I		I		I	839	N		I						
COBITIDAE	*Misgurnus anguillicaudatus*	Pond loach	X			175				I			175	N				I						
CATASTOMIDAE	*Ictiobus cyprinellus*	Bigmouth buffalo	X			*				N				I		I								I
CURIMATIDAE	*Ichthyoelephas humeralis*	Bocachico*	X			12					12	N												
	Prochilodus reticulatus	Bocachico	X			50					50	N												
CHARACIDAE	*Brycon moorei*	Dorada*	X			17					17	N												
	Colossoma macropomum	Cachama*	X			467			132	I	335	N												
	*Piaractus brachypomus**	Cachama blanca*	X			4,047*				I	4,047	N		I										
	*Piaractus mesopotamicus**	Paco*	X							I		N												
ICTALURIDAE	*Ictalurus melas*	Black bullhead	X			1,882				N		I			1,882	I								I
	Ictalurus punctatus	Channel catfish	X			201,329		I	200,003	N		I		I		I		I	1,326	I				
BAGRIDAE	*Chrysichthys nigrodigitatus*	Bagrid catfish	X	X		1,503	1,503	N																
SILURIDAE	*Siluris glanis*	Wels catfish	X			544									542	N			2	N				
PANGASIIDAE	*Pangasius pangasius*	Pangas catfish	X			13,712							13,712	N										
	Pangasius sutchi	Striped catfish	X			*								N										
CLARIIDAE	*Clarias anguillaris*	Mudfish	X			1,185	1,185	N																
	Clarias batrachus	Philippine catfish	X			296				I			280	N		I	16	I						

							Production by continent for native and introduced species																	
Family	Scientific name	Common name	Environment			Production	Africa		America North		America South		Asia		Europe		Oceania		Former USSR	
			FW	BW	SW	1994 (mt)														
	Clarias fuscus	Hong Kong catfish	X			374							374	N				I		
	Clarias gariepinus	North African catfish	X			5,035	3,978	N						I*	1,057	I				
	Clarias macrocephalus	Bighead catfish	X											N				I*		
	Heterobranchus bidorsalis	African catfish*	X					N												
	Heterobranchus longifilis	Sampa*	X					N												
PIMELODIDAE	*Rhamdia sapo*	South American catfish*	X			2					2	N								
CALLICHTHYIDAE	*Hoplosternum littorale*	Atipa*	X									N								
ESOCIDAE	*Esox lucius*	Northern pike	X	X		720		I		N					720	N				N
PLECOGLOSSIDAE	*Plecoglossus altivelis*	Ayu sweetfish	X	X	X	11,586				I			11,586	N						
SALMONIDAE	*Coregonus albula*	Vendace*	X	X												N				N
	Coregonus lavaretus	Whitefish*	X	X	X											N				N
	Oncorhynchus gorbuscha	Pink salmon	X	X	X					N		I		N		I				
	Oncorhynchus keta	Chum salmon	X	X	X					N		I		N		I				I
	Oncorhynchus kisutch	Coho salmon	X	X	X	57,700			278	N	34,524	I	22,824	N	74	I				
	Oncorhynchus masou	Masu salmon	X	X	X	68					68	I		N						
	*Oncorhynchus mykiss**	Rainbow trout	X	X	X	330,471	1,341	I	32,322	N	37,423	I	19,993	I	236,003	I	2,383	I	1,006	I
	Oncorhynchus nerka	Sockeye salmon	X	X	X	20				N		I		N		I	20	I		
	Oncorhynchus tshawytscha	Chinook salmon	X	X	X	20,879			17,900	N	379	I		N		I	2,600	I		
	Salmo salar	Atlantic salmon	X	X	X	366,227		I*	26,332	N	34,175	I			301,720	N	4,000	I		N
	Salmo trutta	Sea trout	X	X	X	4551		I		I		I		N	4501	N		I	50	N
	Salvelinus alpinus	Arctic char	X	X	X	648				N					648	N				N
	Salvelinus fontinalis	Brook trout	X	X	X	321		I		N		I		I	317	I	4	I		I
	Salvelinus namaycush	Lake trout	X	X		11			11	N		I				I		I		
GADIDAE	*Gadus morhua*	Atlantic cod		X	X	80				N					80	N				N
ATHERINIDAE	*Odontesthes bonariensis**	Pejerrey	X	X				I				N		I		I				
SYNBRANCHIDAE	*Monopterus albus**	Lai	X											N				I		

							Production by continent for native and introduced species																	
Family	Scientific name	Common name	Environment			Production	Africa		America		America		Asia		Europe		Oceania		Former	
			FW	BW	SW	1994 (mt)			North		South								USSR	
CENTROPOMIDAE	*Centropomus undecimalis*	Common snook		X	X	331			331	N		N								
	Lates calcarifer	Barramundi*	X	X	X	20,088				I			19,751	N			337	N		
	Lates niloticus	Nile perch	X					N				I								
PERCICHTHYIDAE	*Maccullochella peeli*	Murray cod*	X			18											18	N		
	Macquaria ambigua	Golden perch	X			31											31	N		
	Morone saxatilis	Striped bass	X	X	X			I		N										I
MORONIDAE	*Dicentrarchus labrax*	European seabass	X	X	X	14,281	832	N					736	N	12,713	N				N
SERRANIDAE	*Epinephelus akaara*	Hong Kong grouper			X	30							30	N						
	Epinephelus areolatus	Areolate grouper*			X	508		N					508	N				N		
	Epinephelus tauvina	Greasy grouper			X	1,020		N					1020	N				N		
	Plectropomus maculatus	Spotted coralgrouper			X	90							90	N				N		
TERAPONTIDAE	*Bidyanus bidyanus*	Silver perch	X			27											27	N		
CENTRARCHIDAE	*Micropterus salmoides*	Largemouth black bass	X	X		116		I	116	N		I		I		I		I		I
PERCIDAE	*Perca fluviatilis*	European perch	X			57		I							57	N		I		N
	Stizostedion lucioperca	Pike-perch	X			788	99	I		I				N	621	N			68	N
POMATOMIDAE	*Pomatomus saltatrix*	Bluefish			X			N		N		N		N		N		N		N
CARANGIDAE	*Seriola dumerili*	Greater amberjack			X	30		N		N		N		N	30	N		N		
	Seriola quinqueradiata	Japanese amberjack			X	148,390							148,390	N						
	Trachinotus blochii	Snubnose pompano*			X	329		N					329	N				N		
	Trachinotus carolinus	Florida pompano		X	X					N		N								
	Trachinotus goodei	Palometa pompano		X	X					N		N								
	Trachurus japonicus	Japanese jack mackerel			X	6,134							6,134	N						
LUTJANIDAE	*Lutjanus argentimaculatus*	Mangrove red snapper		X	X	3,235		N					3235	N				N		
	Ocyurus chrysurus	Yellowtail snapper			X					N		N								

							Production by continent for native and introduced species																	
Family	Scientific name	Common name	Environment			Production	Africa		America North		America South		Asia		Europe		Oceania		Former USSR					
			FW	BW	SW	1994 (mt)																		
SPARIDAE	*Acanthopagrus schlegeli**	Dark seabream		X	X	3,474							3474	N										
	*Diplodus sargus**	White seabream		X	X			N						N		N								N
	Evynnis japonica	Crimson seabream			X	52							52	N										
	*Pagrus major**	Red seabream*			X	77,116							77,116	N		I								
	Pagrus pagrus	Red porgy			X	130		N		N		N		N	130	N								
	Rhabdosargus sarba	Goldlined seabream*		X	X	956		N					956	N				N						
	Sparus aurata	Gilthead seabream		X	X	21,202	959	N					6,812	N	13,431	N								
SCIAENIDAE	*Sciaenops ocellatus*	Red drum		X	X	12			12	N														
CICHLIDAE	*Aequidens rivulatus*	Green terror	X									N												
	*Cichlasoma maculicauda**	Blackbelt cichlid	X	X		18			18	N														
	Cichlasoma managuense	Jaguar guapote	X			13			13	N														
	Cichlasoma urophthalmus	Mexican mojarra	X	X	X					N														
	Etroplus suratensis	Pearlspot	X	X				I						N										
	Oreochromis andersonii	Three spotted tilapia	X	X		2,200	2,200	N																
	Oreochromis aureus	Blue tilapia	X	X	X	11,871	74	N	11,797	I		I		N*										I
	Oreochromis macrochir	Longfin tilapia	X			350	350	N										I						
	Oreochromis mossambicus	Mozambique tilapia	X	X	X	51,870	55	N	768	I	14	I	50,884	I		I	149	I						I
	Oreochromis niloticus	Nile tilapia	X	X		426,773	27,162	N	3,343	I	11,220	I	384,976	I		I	72	I						
	Oreochromis spilurus	Tilapia*	X	X	X			N						I		I								
	*Oreochromis urolepis**	Wami tilapia	X	X	X			N		I		I		I										
	Sarotherodon melanotheron	Blackchin tilapia	X	X				N		I								I						I
	Tilapia guineensis	Tilapia*	X	X	X			N																I
	Tilapia rendalli	Redbreast tilapia	X			868	803	N	65	I		I		I				I						
	Tilapia zillii	Redbelly tilapia	X	X	X	18	18	N		I				I				I						I
MUGILIDAE	*Liza aurata*	Golden grey mullet	X	X	X			N						N		N								N
	Liza macrolepis	Largescale mullet		X	X			N						N				N						
	Liza parsia	Gold-spot mullet		X	X									N										
	*Liza ramada**	Thinlip grey mullet	X	X	X			N						N		N								N
	Liza saliens	Leaping mullet		X	X			N						N		N								N
	Liza tade	Tade mullet		X	X			N						N				N						
	Mugil cephalus	Flathead grey mullet	X	X	X	15,361	8,480	N	3	N		N	3,930	N	2,948	N		N						N

Family	Scientific name	Common name	Environment			Production	Production by continent for native and introduced species																	
							Africa		America North		America South		Asia		Europe		Oceania		Former USSR					
			FW	BW	SW	1994 (mt)																		
	Mugil curema	White mullet	X	X	X					N		N												
	*Mugil liza**	Lebranche mullet	X	X	X					N		N												
ELEOTRIDAE	*Dormitator latifrons*	Pacific fat sleeper	X	X	X	250				N	250	N												
	Oxyeleotris marmorata	Marble goby	X			49							49	N										
SIGANIDAE	*Siganus canaliculatus*	White-spotted spinefoot		X	X	3							3	N				N						
	Siganus guttatus	Goldlined spinefoot			X									N										
	Siganus rivulatus	Marbled spinefoot		X	X			N						N		N								
SCOMBRIDAE	*Thunnus maccoyii*	Southern bluefin tuna			X	1,234		N				N		N			1,234	N						
	Thunnus thynnus	Northern bluefin tuna			X	20		N		N		N		N	20	N		N						N
ANABANTIDAE	*Anabas testudineus*	Climbing perch	X			26,944				I*			26,944	N										
BELONTIIDAE	*Trichogaster pectoralis*	Snakeskin gourami	X			18,893						I	18,893	N				I						
HELOSTOMATIDAE	*Helostoma temmincki*	Kissing gourami	X			8,700				I		I	8,700	N										
OSPHRONEMIDAE	*Osphronemus goramy*	Giant gourami	X	X		5,761		I				I	5,761	N				I						
CHANNIDAE	*Channa argus*	Snakehead	X			560							560	N										
	Channa micropeltes	Indonesian snakehead	X			856				I			856	N										
	Channa punctatus	Spotted snakehead	X											N										
	*Channa striata**	Striped snakehead	X			6,500		I					6,500	N				I						
SCOPHTHALMIDAE	*Psetta maxima**	Turbot		X	X	2,434		N			24	I		N	2,410	N								N
PARALICHTHYIDAE	*Paralichthys olivaceus*	Bastard halibut			X	12,562							12,562	N										
SOLEIDAE	*Solea vulgaris**	Common sole		X	X	11	1	N						N	10	N								

3.2 NOTES ON FISHES

SCIENTIFIC NAMES

* In Robins *et al.* (1991b), *Catla catla* is listed as *Gibelion catla* because *Gibelion* Heckel, 1843, predates *Catla* Valenciennes, 1844 (Eschmeyer, 1990). *Catla catla* has been used here because it is more commonly used in the literature.

* *Cirrhinus mulitorella* used in FAO (1996) is a mispelling of *C. molitorella* (Robins *et al.*, 1991b).

* In the synopsis on *Hypophthalmichthys nobilis* (Jennings, 1988) and also in Eschmeyer (1990) and Robins *et al.* (1991a), *Hypophthalmichthys* is considered as the correct genus name and *Aristichthys* (used in FAO, 1996) a subjective synonym.

* *Colossoma bidens* is a synonym of *Piaractus brachypomus* (Hernandez, 1989; Robins *et al.*, 1991b); *Piaractus brachypomum* and *Colossoma brachypomum* are also used for this species but are incorrect.

* *Colossoma mitrei* is considered a synonym of *Piaractus mesopotamicus* (Hernandez, 1989).

* *Oncorhynchus mykiss* is the widely accepted valid name for the rainbow trout, previously named *Salmo gairdneri.*

* The figures reported by Bolivia from 1989 to 1991 to FAO (1996) as *Basilichthys bonariensis* refer to *Odontesthes bonariensis* which is the actual valid name for the species that was introduced in Bolivia (Welcomme, 1988).

* The genus *Fluta* is a synonym of *Monopterus* (Eschmeyer, 1990).

* *Acanthopagrus macrocephalus* used in FAO (1996) is not listed in Japanese books (Masuda *et al.*, 1984; Shirai, 1986); in Robins *et al.* (1991b), *Mylio macrocephalus* is considered a synonym of *Acanthopagrus schlegeli.*

* In this list the subspecies level is not considered, therefore *Diplodus sargus sargus,* for which Turkey reported statistics (FAO, 1996) from 1986 to 1993 (33 t) but not for 1994, is listed only at the species level (*Diplodus sargus*).

* *Chrysophrys major* and *Sparus major* are two synonyms still in use for *Pagrus major* (Robins, 1991b); anyhow the correct taxonomic name for this species is not still completely clearified because what should be the same species is called *Pagrus auratus* in some countries (e.g., Australia, in Kailola *et al.*, 1993).

* *Cichlasoma maculicauda* is used in Ross and Martinez Palacios (1990) and in Robins *et al.* (1991b) instead of *C. maculicaudum* listed in FAO (1996).

* Trewavas (1983) considered *Oreochromis urolepis* a single species with two subspecies, *Oreochromis urolepis urolepis* and *Oreochromis urolepis hornorum*, but in current literature authors often refer to *Oreochromis hornorum* as a valid species. The information regarding the two subspecies have been here gathered under *Oreochromis urolepis*.

* *Mugil capito* is a still in use synonym of *Liza ramada* (Whitehead *et al.*, 1984-86).

* *Mugil brasiliensis* is a synonym of *Mugil liza* (Fischer, 1978) that is still used.

* According with Kottelat (1989) and Robins *et al.* (1991b), *striata* is the correct species name for *Channa* instead of *striatus*.

* As already said above, the subspecies level is not considered here *so Psetta maxima maxima* is listed as *Psetta maxima*.

* *Solea solea* is synonym of *Solea vulgaris* still in use (Fischer *et al.*, 1987).

COMMON NAMES

* Bocachico is a common name used in Latin America for species belongig to the family Curimatidae; it is applied also to *Ichthyoelephas humeralis* in the only reference (Cadena, 1981) found on this species in ASFA (1993,1996) records from 1978 to 1995.

* Dorada is a FAO Spanish name for Sparidae species but it is also used as common name for Brycon moorei (Otero, 1989).

* *Colossoma macropomum* is called cachama or cachama negra in Spanish speaking countries (Hernandez, 1989) and tambaqui in Brazil (Araujo, 1989).

* Pirapitinga is the vernacular name used in Brazil for *Piaractus brachypomus* (Araujo, 1989).

* Pacu is the Brazilian name for *Piaractus mesopotamicus* (Araujo, 1989).

* For *Heterobranchus bidorsalis* no more specific common name has been found than African catfish used in the literature (ASFA, 1996).

* Sampa, probably a local name, is listed in Robins *et al.* (1991b) as common name for *Heterobranchus longifilis*.

* South American catfish, although very generic, is the common name used for *Rhamdia sapo* in the literature (ASFA, 1996).

* In current literature (ASFA, 1996) the vernacular name atipa is used for *Hoplosterum littorale* instead of the name hassar listed in FAO (1996).

* Whitefish (CEC, 1993) and European whitefish (FAO, 1994a) are other common names used for *Coregonus albula*.

* Powan and pollan are others common names in English used for *Coregonus lavaretus* (CEC,1993).

* Barramundi, listed in FAO (1996) as the English FAO name for *Lates calcarifer* is mainly used in Australia, while in Asia this species is called Asian seabass or Giant seaperch (Robins, 1991b).

* Murray cod, the vernacular name used for *Maccullochella peeli* in Australia, has been preferred to Murray perch listed in FAO (1996).

* Areolate grouper is the English FAO name used in the FAO groupers catalogue (Heemstra and Randall, 1993) and is less generic than brown spotted grouper listed in FAO (1996).

* Snubnose pompano is the common name used in Fischer and Bianchi (1984) and Robins (1991b) for *Trachinotus blochii* and is less generic than Asian pompano used in FAO (1996).

* Red seabream is the common name used in the literature (ASFA, 1996) for *Pagrus major*, instead, the name silver seabream, listed in FAO (1996), is often used as common name for *Rhabdosargus sarba*.

* Tilapia is a common name used for all *Oreochromis*, *Sarotherodon* and *Tilapia* species; no more specific name has been found in use for *Oreochromis spilurus* and *Tilapia guineensis*.

PRODUCTION

* The total production of 202 t reported by Mali (2 t) and Nigeria (200 t) in FAO (1996) as *Heterotis* spp. probably refer *to Heterotis niloticus*.

* The single ton reported in 1994 (9 t in 1993) by Kazakstan to FAO (1996) as production of *Aspius* spp. should belong to *Aspius aspius*: in fact, all the articles consulted through ASFA (1996) regarding aquaculture of *Aspius* spp. in that area deal with *Aspius aspius*.

* The 2,500 t reported by France as production of *Rutilus* spp. should belong to *Rutilus rutilus*: in fact, all the articles consulted through ASFA (1996) regarding *Rutilus* spp. cultivated in France deal with *Rutilus rutilus*.

* Production figures reported by Ukraine (1 t) as *Ictiobus* spp. could belong either to *Ictiobus cyprinellus* or to *Ictiobus niger*, both species being introduced in the country (Welcomme, 1988).

* Production figures (27 t) reported by Peru as *Colossoma bidens* in FAO (1996) have been added to those of *Colossoma brachypomum* under the correct name of *Piaractus brachypomus* (see Taxonomy notes).

* Production figures (13,189 t) reported by Thailand for *Pangasius pangasius* could also refer to *Pangasius sutchi* which is commonly cultivated in Thailand.

GEOGRAPHICAL DISTRIBUTION

* Geographical distribution of *Abramis brama* and *Aspius aspius* in Asia is restricted to a small area in Turkey (Blanc *et al.*, 1971).

* According to Hecht *et al.* (1992), *Hypophthalmichthys nobilis*, *Mylopharyngodon piceus* and *Salmo salar* have been imported in South Africa to experiment their culture.

* *Clarias gariepinus* has been introduced in Asian countries as described in Rahman *et al.* (1992).

* *Clarias macrocephalus* is listed in Nelson (1989) as cultured commercially in Guam: it has probably been introduced in the island but no record has been found.

* The native range of *Oreochromis aureus* in Asia is restricted to Israel and Jordan (Trewavas, 1983).

* An introduced population of *Anabas testudineus* was recorded in Florida (Courtenay and Robins, 1973) but it was later considered as extirpated (Courtenay *et al.*, 1986).

4. CRUSTACEANS

4.1 LIST OF CRUSTACEAN SPECIES

N = Native I = Introduced

							Production by continent for native and introduced species															
Family	Scientific name	Common name	Environment			Production	Africa		America North		America South		Asia		Europe		Oceania		Former USSR	
			FW	BW	SW	1994 (mt)														
PENAEIDAE	*Metapenaeus dobsoni*	Kadal shrimp		X	X									N						
	Metapenaeus endeavouri	Endeavour shrimp		X	X	1,843*							1,843					N*		
	Metapenaeus ensis	Greasyback shrimp		X	X									N				N		
	Metapenaeus monoceros	Speckled shrimp		X	X			N						N						
	Penaeus aztecus	Northern brown shrimp		X	X					N		I								
	*Penaeus chinensis**	Fleshy prawn		X	X	64,389				I			64,389	N		I		I		
	Penaeus esculentus	Brown tiger prawn		X	X													N		
	Penaeus indicus	Indian white prawn		X	X	2,244	40	N					2,204	N				N		
	Penaeus japonicus	Kuruma prawn		X	X	2,295	1	N				I	2,136	N	125	I	33	N		
	Penaeus kerathurus	Caramote prawn		X	X			N						N		N				
	Penaeus merguiensis	Banana prawn		X	X	43,522							43,522	N				N		
	Penaeus monodon	Giant tiger prawn*		X	X	505,658	584	N		I		I	503,694	N	1	I	1,379	N		
	Penaeus notialis	Southern pink shrimp		X	X			N		N		N								
	Penaeus paulensis	Sao Paulo shrimp		X	X							N								
	Penaeus penicillatus	Redtail prawn		X	X	217						I	217	N						
	Penaeus schmitti	Southern white shrimp		X	X					N		N								
	Penaeus semisulcatus	Green tiger prawn		X	X			N						N				N		
	Penaeus setiferus	Northern white shrimp		X	X					N										
	Penaeus stylirostris	Blue shrimp		X	X	11,973			758	N	11,215	N		I				I		
	Penaeus subtilis	Southern brown shrimp		X	X					N		N								
	Penaeus vannamei	Whiteleg shrimp		X	X	109,447			9,038	N	100,409	N		I				I		
	Xiphopenaeus kroyeri	Atlantic seabob	X	X	X	50				N	50	N								
SERGESTIDAE	*Acètes japonicus*	Akiami paste shrimp			X	200							200	N						
PALAEMONIDAE	*Macrobrachium malcolmsonii*	Monsoon river prawn	X	X										N						
	Macrobrachium rosenbergii	Giant river prawn	X	X	X	20,759*	98	I	1,706	I	1,757	I	17,067	N	36		95	N		I
	Palaemon serratus	Common prawn		X	X	30		N						N	30	N				N

Family	Scientific name	Common name	Environment			Production	Production by continent for native and introduced species															
							Africa		America North		America South		Asia		Europe		Oceania		Former USSR			
			FW	BW	SW	1994 (mt)																
NEPHROPIDAE	*Homarus americanus*	American lobster			X					N		N		I								
	Homarus gammarus	European lobster			X			N						N*		N						
ASTACIDAE	*Astacus astacus*	Noble crayfish	X													N						N
	Astacus leptodactylus	Danube crayfish	X	X										N		N						N
	Pacifastacus leniusculus	Signal crayfish	X			3				N		N			3	I						I
CAMBARIDAE	*Procambarus clarkii*	Red swamp crawfish	X	X		24,593		I	22,493	N		I		I	2,100	I		I				
PARASTACIDAE	*Cherax destructor*	Yabby crayfish	X	X		336											336	N				
	Cherax quadricarinatus	Red claw crayfish	X			35				I							35	N				
	Cherax tenuimanus	Marron crayfish	X			23	2	I		I				I		I	21	N				
PALINURIDAE	*Panulirus longipes*	Longlegged spiny lobster			X	7		N					7	N				N				
PORTUNIDAE	*Portunus trituberculatus*	Gazami crab*			X									N								
	Scylla serrata	Indo-Pacific swamp crab*		X	X	7,958	5	N					7,953	N				N				
POTAMIDAE	*Eriocheir sinensis*	Chinese river crab*	X	X	X	31,230				I*			31,230	N		I*						

4.2 NOTES ON CRUSTACEANS

SCIENTIFIC NAMES

* *Penaeus orientalis* is often used in place of *Penaeus chinensis* but is recognized as a synonym (Holthuis, 1980).

COMMON NAMES

* Black tiger shrimp is another name often used for *Penaeus monodon* (ASFA, 1996).

* Swimming crab is the most common name for *Portunus trituberculatus* (ASFA, 1996), but it is too generic.

* Indo-Pacific swamp crab has been chosen to replace mud crab as FAO English Name for *Scylla serrata* (FAO, 1994a).

* Chinese mitten crab is another name often used for *Eriocheir sinensis* (ASFA, 1996).

PRODUCTION

* In FAO (1995d) the production previously reported by Philippines as *Peneaus indicus* (FAO, 1994b) was moved under *Metapenaeus endeavouri* but this species, according to Holthuis (1980) and Dore and Frimodt (1987) is distributed only along the west, north and east coasts of Australia where is a fisheries resource but is not cultured (Kailola *et al.*, 1993). No one report of its introduction in the Philippines has been found in ASFA (1996) nor *M. endeavouri* is mentioned as one of the marine shrimp species (*Penaeus monodon, Penaeus indicus, Penaeus merguensis, Metapenaeus ensis*) commercially cultivated in the Philippines (Rabanal and Soesanto, 1987). Then, the 1,843 t reported for *Metapenaeus endeavouri* in FAO (1996) could still probably belong to *Penaeus indicus*. In this case *Metapenaeus endeavouri* should be cancelled from this list.

* The production of 12,500 t reported (FAO, 1996) by Viet Nam under the item "Freshwater crustaceans not identified" should belong to *Macrobrachium rosenbergii* which is the most important freshwater crustacean cultivated in Vietnam (Lin and Lee, 1992, Hung, 1992).

GEOGRAPHICAL DISTRIBUTION

* Geographical distribution of *Metapenaeus endeavouri* is reported as restricted to west, north and east coasts of Australia (Holthuis,1980; Dore and Frimodt, 1987) but statistics for this species has been reported by Philippines (FAO, 1995d and 1996). See above, under Production, for other details.

* Geographical distribution of *Homarus gammarus* in Asia is restricted to a small area of Turkey (Holthuis, 1991).

* *Eriocheir sinensis* was introduced in Europe (Welcomme, 1988) and in North America (Willams *et al.*, 1989) probably in the ballast water of ships (Moyle, 1991). The species, considered a delicacy in China, is a pest in Europe (Welcomme, 1988).

5. MOLLUSCS

5.1 LIST OF MOLLUSC SPECIES

N = Native I = Introduced

							Production by continent for native and introduced species															
Family	Scientific name	Common name	Environment			Production	Africa		America North		America South		Asia		Europe		Oceania		Former USSR	
			FW	BW	SW	1994 (mt)														
HALIOTIDAE	*Haliotis discus**	Japanese abalone			X									N						
	Haliotis diversicolor	Small abalone			X	*								N						
	Haliotis midae	Perlemoen abalone			X	2	2	N												
	Haliotis rufescens	Red abalone			X					N		N								
	*Haliotis tuberculata**	European abalone*			X	6		N						N	6	N				
LITTORINIDAE	*Littorina littorea*	Common periwinkle*			X	*				I						N				
STROMBIDAE	*Strombus gigas*	Pink conch*			X	*				N		N								
MYTILIDAE	*Aulacomya ater*	Cholga mussel		X	X	120		N			120	N						N		
	Choromytilus chorus	Choro mussel		X	X	117					117	N								
	Mytilus californianus	Californian mussel		X	X					N										
	*Mytilus chilensis**	Chilean mussel		X	X	9,490					9,490	N								
	*Mytilus coruscus**	Korean mussel		X	X	39,764*							39,764	N						N
	Mytilus edulis	Blue mussel		X	X	325,460*	10	N	7,861	N		N		N	317,589	N				N
	Mytilus galloprovincialis	Mediterranean mussel		X	X	108,808	2,355	N		I				N	105,639	N			814	N
	*Mytilus planulatus**	Australian mussel *		X	X	765											765	N		
	*Perna canaliculus**	New Zealand mussel*		X	X	47,000											47,000	N		
	Perna indica	Indian brown mussel		X	X									N						
	Perna perna	South American rock mussel			X	75		N		I	75	N								
	*Perna viridis**	Green mussel		X	X	39,551*							39,551	N				N		
ARCIDAE	*Anadara granosa**	Blood cockle*		X	X	185,599							185,599	N						
	*Scapharca broughtonii**	Inflated ark			X	*								N						
	*Scapharca subcrenata**	Half-crenate ark			X	*								N						
PTERIIDAE	*Pinctada fucata**	Japanese pearl oyster		X	X	*		N						N				N		

Family	Scientific name	Common name	Environment			Production	Production by continent for native and introduced species															
							Africa		America North		America South		Asia		Europe		Oceania		Former USSR			
			FW	BW	SW	1994 (mt)																
	Pinctada margaritifera	Black-lip pearl oyster			X	*		N		N				N				N				
	Pinctada maxima	Silver-lip pearl oyster*			X	*								N				N				
	Pteria penguin	Penguin wing oyster			X	*								N				I				
PECTINIDAE	*Aequipecten opercularis**	Queen scallop			X	38		N							38	N						
	Argopecten irradians	Atlantic bay scallop		X	X					N		N *		I								
	Argopecten purpuratus	Peruvian calico scallop			X	11,236				N	11,236	N										
	*Argopecten ventricosus**	Pacific calico scallop			X	41			41	N		N										
	Chlamys farreri	Farrer's scallop			X	*								N								N
	Chlamys islandica	Iceland scallop			X					N						N						N
	Chlamys nobilis	Noble scallop		X	X									N								
	*Patinopecten yessoensis**	Yesso scallop			X	1,025,979				I			1,024,978	N					1,001	N		
	Pecten fumatus	Australian southern scallop			X	110											110	N				
	Pecten maximus	Great Atlantic scallop*			X	648		N							648	N						
	Pecten novaezelandiae	New Zealand scallop			X	120											120	N				
	Placopecten magellanicus	American sea scallop*			X	40			40	N												
OSTREIDAE	*Crassostrea belcheri**	Lugubrious cupped oyster		X	X									N								
	Crassostrea corteziensis	Cortez oyster		X	X					N		N										
	*Crassostrea gigas**	Pacific cupped oyster*		X	X	961,867*	818	I	69,402	I	1,130	I	734,666	N	150,771	I	5,080	I				
	Crassostrea iredalei	Slipper cupped oyster*		X	X	11,697							11,697	N								
	Crassostrea madrasensis	Indian backwater oyster		X	X									N								
	Crassostrea rhizophorae	Mangrove cupped oyster		X	X	417			415	N		N					2	I				
	Crassostrea rivularis	Suminoe oyster	X	X	X					I				N								
	Crassostrea virginica	American cupped oyster		X	X	89,737			89,737	N						I						
	Ostrea chilensis	Chilean flat oyster		X	X	167					167	N										
	Ostrea edulis	European flat oyster		X	X	5,794	1	N	11	I				N	5,782	N						N
	Ostrea lurida	Olympia flat oyster		X	X	136			136	N												
	*Saccostrea commercialis**	Sidney rock oyster*		X	X	6,378											6,378	N				
	Saccostrea cucullata	Hooded oyster		X	X	12	12	N						N		I						
	Saccostrea echinata	Spiny oyster		X	X									N				N				
CARDIIDAE	*Cerastoderma edule**	Common edible cockle		X	X	2,333		N							2,333	N						N

Family	Scientific name	Common name	Environment			Production	Production by continent for native and introduced species															
							Africa		America North		America South		Asia		Europe		Oceania		Former USSR			
			FW	BW	SW	1994 (mt)																
TRIDACNIDAE	*Tridacna derasa*	Smooth giant clam			X									N				N				
	Tridacna gigas	Giant clam			X									N				N				
MACTRIDAE	*Mactra glabrata*	Smooth mactra			X			N														
	Mactra veneriformis	Globose clam			X	429							429	N								
	Spisula solidissima	Atlantic surf clam		X	X					N												
SOLECURTIDAE	*Sinonovacula constricta*	Constricted tagelus		X*		*								N								
CORBICULIDAE	*Corbicula fluminea*	Asian clam	X	X		*				I				N								
	Corbicula japonica	Japanese corbicula		X	X	11,147*							11,147	N								
VENERIDAE	*Mercenaria mercenaria*	Northern quahog*		X	X	7,944*			7,944	N						I						
	Meretrix lusoria	Japanese hard clam			X	77*							77	N								
	Meretrix meretrix	Asiatic hard clam		X	X	*								N								
	Paphia undulata	Undulate venus			X									N								
	Protothaca staminea	Pacific littleneck clam			X	98			98	N												
	Ruditapes decussatus	Grooved carpet shell		X	X	6,898*	16	N						N	6,882	N						
	Ruditapes philippinarum	Japanese carpet shell*		X	X	542,223*			2,444	N			539,758	N	21	I						
	Saxidomus giganteus	Butter clam			X	14			14	N												
	*Venerupis pullastra**	Pullet carpet shell*			X	2		N						N	2	N						
MYIDAE	*Mya arenaria*	Sand gaper*		X	X	32			32	N				N		N						N
HIATELLIDAE	*Panopea abrupta*	Pacific geoduck			X					N												

5.2 NOTES ON MOLLUSCS

SCIENTIFIC NAMES

* The taxonomy of *Haliotis discus* is very confused (Hahn, 1989). A subspecies, *H. discus hannai*, is recognized in Japanese waters, but *H. discus hannai* is morphologically, ecologically and genetically different from *H. discus* (Ino, 1980).

* *Haliotis tuberculata* (Fischer *et al.*, 1987) is the correct species name instead of *Haliotis tubercolata* listed in FAO (1996).

* *Mytilus chilensis* is often considered as a local form of *Mytilus edulis* (De Franssu, 1990).

* *Mytilus crassitesta* (FAO, 1996) is a synonym of *Mytilus coruscus* (Poutiers, 1993a).

* *Mytilus planulatus* is treated as a subspecies of *Mytilus edulis* by some authors (*Mytilus edulis planulatus* in Kailola *et al.*, 1993).

* *Mytilus canaliculus* (FAO, 1996) is a synonym of *Perna canaliculus* (Paul, 1986; Poutiers, 1993a).

* *Mytilus smaragdinus* and *Mytilus viridis* (FAO, 1996) are synonyms of *Perna viridis* (Poutiers, 1993a).

* *Arca granosa* and *Tegillarca granosa* are synonyms sometimes used instead of the correct *Anadara granosa* (Poutiers, 1993a)

* *Anadara broughtonii* and *Arca inflata* are synonyms sometimes used for *Scapharca broughtonii* (Poutiers, 1993a).

* *Anadara subcrenata* and *Arca subcrenata* are synonyms sometimes used for *Scapharca subcrenata* (Poutiers, 1993a).

* *Pinctada vulgaris* is a synonym of *Pinctada fucata* (Alagarswami, 1991; Poutiers, 1993a). Japanese taxonomists recognized *Pinctada fucata martensii* as a subspecies of *P. fucata* (Wada, 1991).

* *Chlamys opercularis* (FAO, 1996) is a synonym of *Aequipecten opercularis* (Fischer *et al.*, 1987; Poutiers, 1993a).

* *Argopecten circularis*, listed in FAO (1996), is considered by Waller (1991) and Poutiers (1995) a synonym of *Argopecten ventricosus* but most of mexican papers (Felix-Pico, 1991; ASFA, 1996) consider *Argopecten circularis* as a valid species.

* *Pecten yessoensis* (FAO, 1996) is a synonym of *Patinopecten yessoensis* (Poutiers, 1993a).

* *Crassostrea* (or *Saccostrea*) *lugubris* is a synonym of *Crassostrea belcheri* (Poutiers, 1993a).

* *Crassostrea angulata* (FAO, 1996) is a synonym of *Crassostrea gigas* (Fischer *et al.*, 1987; De Franssu, 1990; Poutiers, 1993a).

* *Crassostrea commercialis* (FAO, 1996) is treated by some authors (De Franssu, 1990; Poutiers, 1993a) as a synonym of *Crassostrea cucullata* but in Australia, where it is extensively cultured (6,378 t in 1994), it is considered as a valid distinct species belonging to the genus *Saccostrea* (Kailola *et al.*, 1993).

* *Cardium edule* (FAO, 1996) is a synonym of *Cerastoderma edule* (Tebble, 1966).

* *Tapes pullastra* (FAO, 1996) is a synonym of *Venerupis pullastra* (Fischer *et al.*, 1987; De Franssu, 1990; Poutiers, 1993a).

COMMON NAMES

* Ormer is another common name often used for *Haliotis tuberculata* (ASFA, 1996).

* Common periwinkle used in Turgeon *et al.* (1988) is a bit more specific than periwinkle used in FAO (1995c).

* Queen conch is another name often used for *Strombus gigas* (Appeldoorn and Rodríguez, 1994).

* The Australian name for *Mytilus planulatus* is blue mussel (Kailola *et al.*, 1993).

* *Perna canaliculus* is called green mussel in New Zealand (Paul, 1986).

* Another English common name often used for *Anadara granosa* is granular ark (De Franssu, 1990).

* *Pinctada maxima* is also called gold-lip pearl oyster (Alagarswami, 1991; Gervis and Sims, 1992).

* Great Atlantic scallop used in De Franssu (1990) is less generic than common scallop used for *Pecten maximus* in FAO (1996).

* American sea scallop has replaced sea scallop as the FAO English name for *Placopecten magellanicus* (FAO, 1994a and 1996). Probably, the common name Atlantic deep-sea scallop used by Abbott (1968) would define still better this species.

* Slipper cupped oyster (De Franssu, 1990) is more used than Philippine cupped oyster (FAO, 1996) in papers dealing with *Crassostrea iredalei* (ASFA, 1996).

* Sidney rock oyster is the Australian vernacular name for *Saccostrea commercialis* (Kailola, 1993; ASFA, 1996).

* Northern quahog has replaced hard clam as the FAO English name for *Mercenaria mercenaria* (FAO, 1994a and 1996).

* Japanese carpet shell is the FAO English name for *Ruditapes philippinarum* (De Franssu, 1990; FAO, 1996). Other names often used are Manila clam and Japanese littleneck.

* Pullet carpet shell is used as FAO English name in Fischer *et al.* (1987) and De Franssu (1990) instead of the less precise carpet shell listed in FAO (1996).

* Sand gaper (De Franssu, 1990) is the most definite name for *Mya arenaria.* Other names such as soft clam, soft shell and soft shell clam are also used but are too generic.

PRODUCTION

* Production of 1,048 t of *Haliotis* spp. listed in FAO (1996) under Other Asia could belong to *Haliotis diversicolor* (Hahn, 1989).

* Being *Littorina littorea* the only *Littorina* species of commercial importance in France (Poutiers, 1993b) the production (1,110 t) of *Littorina* spp. reported to FAO (1996) by France should belong to *Littorina littorea*.

* Production of 6 t of *Strombus* spp. reported to FAO (1996) by Netherlands Antilles (5 t) and Turks and Caicos (1 t) should belong to *Strombus gigas* (Hensen, 1991; Appeldoorn and Rodríguez, 1994).

* According with Menzel (1988) and Nie (1991) the three most important mussel species cultivated in China are *Mytilus edulis*, *Perna viridis* and *Mytilus coruscus*. The production of 415,222 t reported by China as Mytilidae to FAO (1996) probably belong to these three species.

* The production reported to FAO (1996) as *Mytilus smaragdinus* (38,582 t) and *Mytilus viridis* (969 t) have been merged under *Perna viridis* (see Scientific names above).

* The production of 13,646 t reported by Korea Rep. as *Arca* spp. (FAO, 1996) should belong to one or more of the three Arcidae species listed (*Anadara granosa, Scapharca broughtonii* and *Scapharca subcrenata*).

* Statistics for pearl oysters are not reported to FAO (1996) at the species level and are grouped under the name "Ex *Pinctada* spp.". The most part (93% of 17,351 t) of the total production is reported by Japan where all four the species listed are cultivated; according with figures on spat production in Japan (Wada, 1993), other sources such as Gervis and Sims (1992) and the number of records in ASFA (1996), the species which probably gives the highest contribution to the production figures is *Pinctada fucata* .

* *Chlamys farreri* is an important species in Chinese aquaculture. Rucai and Lian-chen (1991) reported a production of about 7,500 t for each year from 1983 to 1985 in the Changdao County and Shandong Province.

* Production reported for *Crassostrea angulata* (15,000 t by France and 1,063 t by Portugal) have been merged with those of *Crassostra gigas* (see under Scientific Names above).

* In Nie's revision (1991) on bivalve aquaculture in China no *Solen* species is included, while it is stated that "Over half of the total yield of cultivated species of bivalves in the Provinces of Fujian and Zhejiang is of this species [*Sinonovacula constricta*]." This quotation and also the number of papers dealing with *Sinonovacula constricta* in China (25 papers listed in ASFA, 1996, compared to only 2 about *Solen* spp.) indicate that the production figures (252,886 t) reported by China to FAO (1996) as *Solen* spp. should instead belong to *Sinonovacula constricta* which is also similar in shape to *Solen* spp.

* Part or all the production (11,147 t) reported for *Corbicula japonica* by Other Asia and grouped under the category Freshwater molluscs in FAO (1996) could probably belong to *Corbicula fluminea*: in fact, *C. fluminea* is a freshwater-brackish water species while *C. japonica* is a marine-brackish water species and *C. fluminea* seems also more common as cultured species in Asia, in particular in Taiwan (Lovatelli, 1988; Liao, 1990) while *C. japonica* is a major commercial species in Japan (Poutiers,

1993a). The commercial culture of *C. fluminea* has been considered in the U.S. (Phelps, 1992) where the species has been introduced by Asian immigrants in the 30's but its release in the environment has affected local mussel populations in streams (Neves and Williams, 1994).

* There are also 19,587 t reported for *Mercenaria mercenaria* to FAO (1996) as Other Asia, but this production can not belong to this species because it is distributed only in Central and North Atlantic and has been introduced in Europe (Utting and Spencer, 1992); no record has been found of any introduction in Asia. The production reported probably belong to *Meretrix lusoria* which is called hard clam as *Mercenaria mercenaria* (see Common Names above).

* The production reported by Italy (27,000 t) under *Tapes* spp. (FAO, 1996) could either belong to *Ruditapes decussatus* or *Ruditapes philippinarum*.

ENVIRONMENT

* *Sinonovacula constricta* occurs in estuaries and bays with little freshwater inflow, at salinities of 4 to 29U, optimum 7 to 26U (Nie, 1991).

GEOGRAPHICAL DISTRIBUTION

* *Argopecten irradians* is present in South America with the subspecies *A. irradians amplicostatus* (Abbott, 1968, Cervigon *et al.*, 1992).

6. CONCLUDING REMARKS

Data on production, number of species and introduced species from the three major animal groups have been summarized in Table 1. As it is shown in Figure 2, Asia produces most of world's aquaculture (84.9% of the total production reported at the species level to FAO, 1996). Europe is the second continent in quantity of aquaculture production but produces only 8.2% of the total. This striking difference from Asia and the other continents is not so evident in the number of species: in fact, the Asian production of more than 13 million of tons comes from the culture of 75 species while Europe produce ten times less using more than half the number of species used in Asia (Table 1).

Regarding introduced species, Asia, together with the Former USSR, is the continent in which introduced species give the lowest contribution to the total production of the continent (Figure 3). In Asia there are many important cultivated species native of the continent and then only four species have been introduced from other continents. Introduced species form a very important part of aquaculture production in other continents: 97.1% of crustaceans production in Europe, 96.2% of fishes production in South America, 84.7% in Oceania. Overall, 9.7% of aquaculture production comes from introduced species.

Although this list shows that world animal aquaculture is mainly based on about 260 species, the bulk of the production comes from a much more limited number of species. In fact, 31 species account for 95% of the total production reported to FAO (1996) (Table 2). Pullin (1995), using FAO and Taiwanese official statistics, made an estimate much higher: 105 finfish, 43 molluscs, 27 crustaceans and 6 seaweeds species would produce the 95% of farmed aquatic production. A similar exercise has been done for agriculture (Prescott-Allen and Prescott-Allen, 1990) and it demonstrated that 103 species of plants contribute 90% of the world's plant food supply and 95% of livestock production comes from 5 species of animals.

Among the three major groups, 17 finfish species constitute 95% of the total fish production reported to FAO at the species level: between these, the first five and a total of eleven are cyprinids (Figure 4). Crustaceans have the smallest number of species reported, but the highest percentage of species contributing to the 95% of total production which means that the bulk of production is distributed on a higher number of species in proportion (Table 2). On the total, about one fifth (18.9%) of the species reported produce the 95% of the total production at the species level.

The number of species important to aquaculture is steadily increasing but not at the rate that was expected as a consequence of the effort of researchers and farmers in experimenting new species suitable for aquaculture: considering a period of eleven years from 1984 to 1994, the total number of reports to FAO, at the species and at other taxonomic levels, has increased by 24.6%, respectively 39.1% at the species level and 18.5% at less defined taxonomic levels (Table 3). This could indicate a slight increase in the accuracy of the reporting of production data by Member countries but many problems still remain to be solved to improve the quality of aquaculture statistics (FAO, 1995b).

Table 1. Summary of production data (FAO, 1996) by continent for native and introduced species
(n = number of species)

FISHES

	Africa			America, North			America, South			Asia			Europe			Oceania			Former USSR			Total		
	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%
Native species	15	47,981	85.2	14	287,235	90.3	7	4,713	3.8	49	8,949,705	91.4	22	426,994	63.7	6	1,673	15.3	8	121,712	95.9	121	9,840,013	88.6
Introduced species	5	8,363	14.8	8	30,950	9.7	9	118,045	96.2	4	845,179	8.6	8	243,630	36.3	10	9,256	84.7	3	5,242	4.1	47	1,260,665	11.4
Total by continent	20	56,344		22	318,185		16	122,758		53	9,794,884		30	670,624		16	10,929		11	126,954		168	11,100,678	

CRUSTACEANS

	Africa			America, North			America, South			Asia			Europe			Oceania			Former USSR			Total		
	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%
Native species	4	630	86.3	3	32,289	95.0	3	111,674	98.5	12	674,462	100	2	66	2.9	6	1,899	100	0	0		30	821,020	99.3
Introduced species	2	100	13.7	1	1,706	5.0	1	1,757	1.5	0	0		4	2,229	97.1	0	0		0	0		8	5,792	0.7
Total by continent	6	730		4	33,995		4	113,431		12	674,462		6	2295		6	1899		0	0		38	826,812	

MOLLUSCS

	Africa			America, North			America, South			Asia			Europe			Oceania			Former USSR			Total		
	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%
Native species	6	2,396	74.5	11	108,762	61.0	6	21,205	94.9	10	2,587,666	100	9	438,919	74.4	5	54,373	91.5	2	1,815	100	49	3,215,136	93.4
Introduced species	1	818	25.5	2	69,413	39.0	1	1,130	5.1	0	0		2	150,792	25.6	2	5,082	8.5	0	0		8	227,235	6.6
Total by continent	7	3,214		13	178175		7	22,335		10	2,587,666		11	589,711		7	59,455		2	1,815		57	3,442,371	

TOTAL ANIMAL SPECIES

	Africa			America, North			America, South			Asia			Europe			Oceania			Former USSR			Total		
	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%	n	mt	%
Native species	25	51,007	84.6	28	428,286	80.8	16	137,592	53.2	71	12,211,833	93.5	33	865,979	68.6	17	57,945	80.2	10	123,527	95.9	200	13,876,169	90.3
Introduced species	8	9,281	15.4	11	102,069	19.2	11	120,932	46.8	4	845,179	6.5	14	396,651	31.4	12	14,338	19.8	3	5,242	4.1	63	1,493,692	9.7
Total by continent	33	60,288		39	530,355		27	258,524		75	13,057,012		47	1,262,630		29	72,283		13	128,769		263	15,369,861	

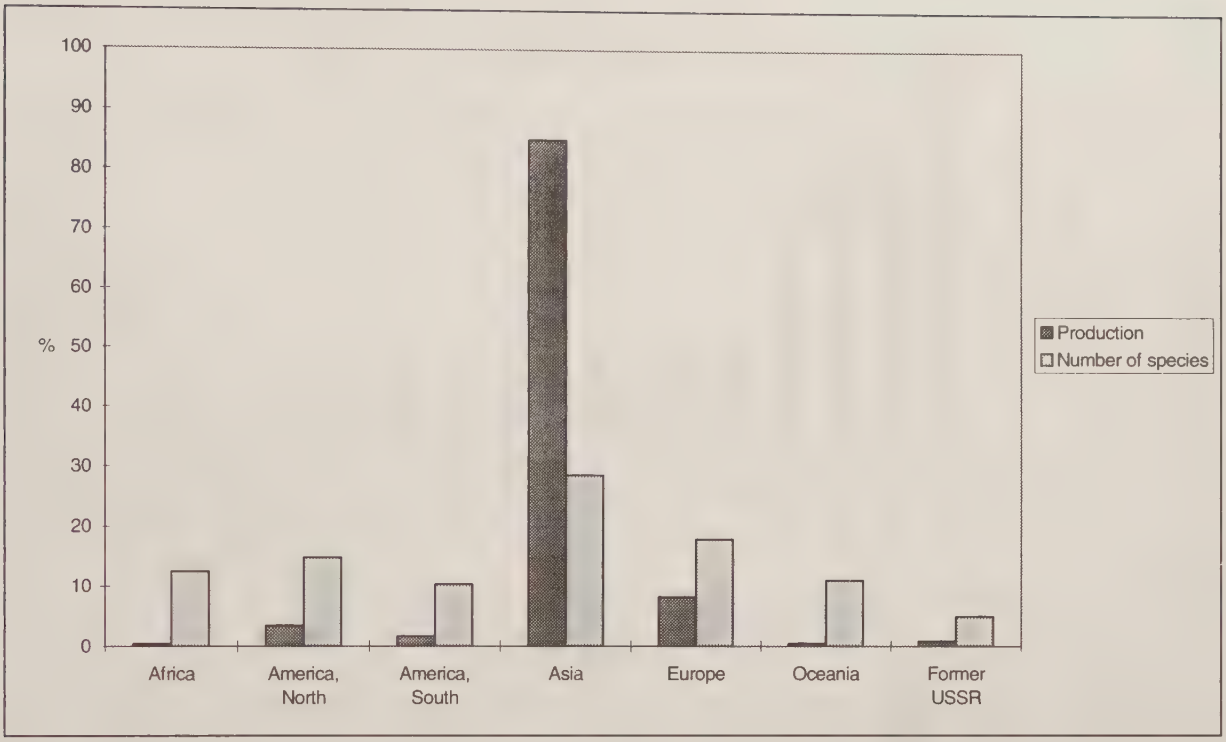

Figure 2. Percentage of aquaculture production and number of species of each continent on the total

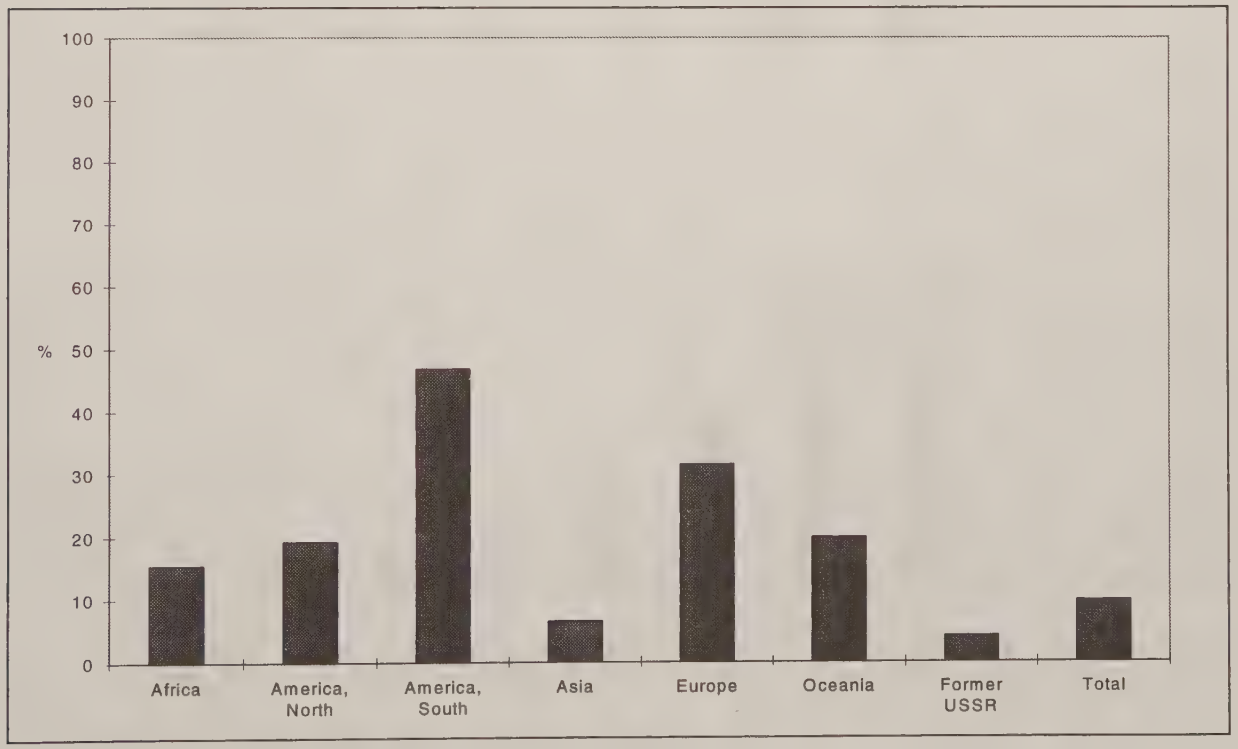

Figure 3. Percentage of introduced species production on total production of each continent

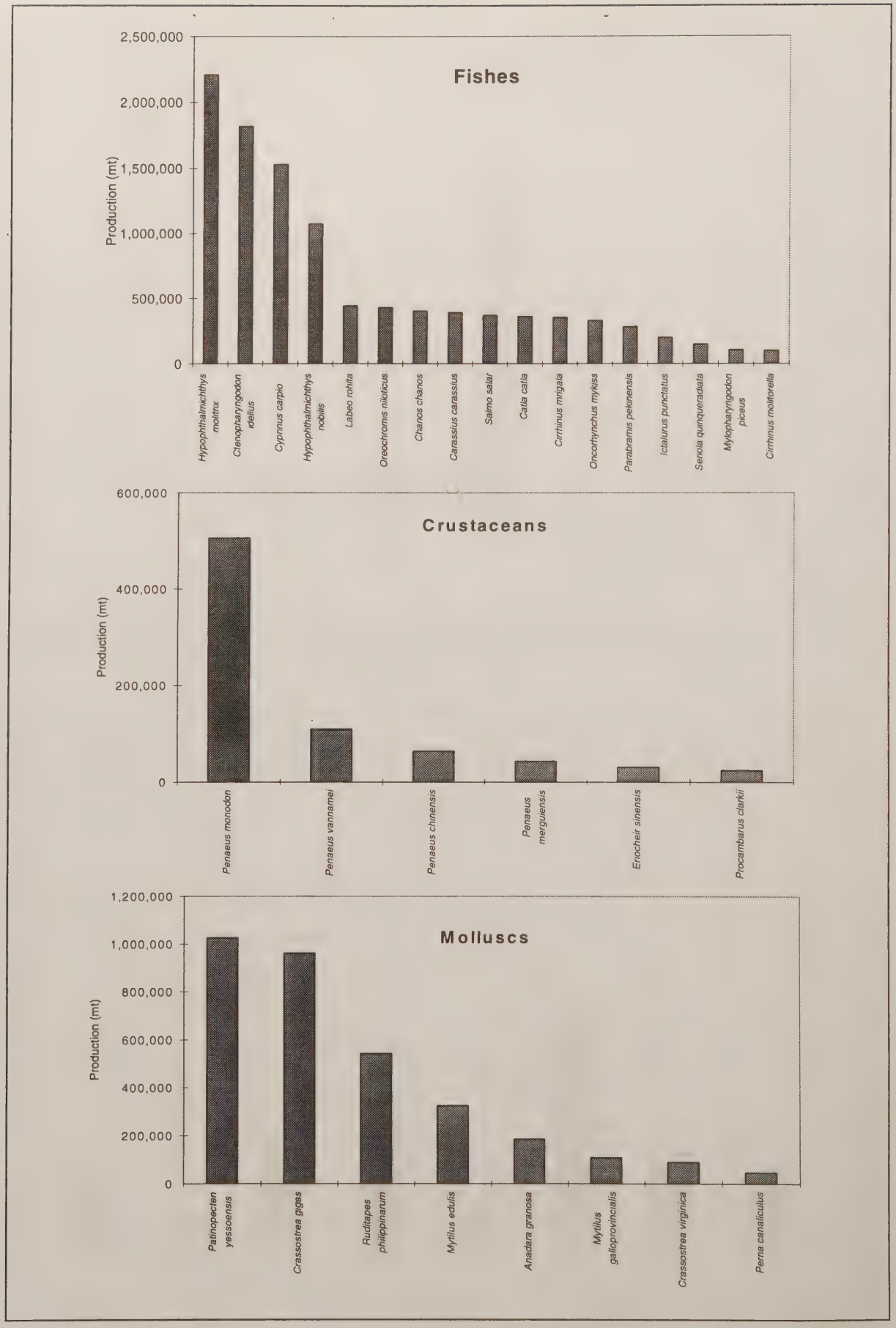

Figure 4. Species accounting 95% of the total production of each major animal group

Table 2. Number of species having production figures (FAO, 1996) and accounting for 95% of production for each major animal group

Major animal group	Number of species having production figures	Number of species accounting for 95% of production	%
Fishes	102*	17	16.7
Crustaceans	21	6	28.6
Molluscs	41*	8	19.5
Total	164*	31	18.9

*The productions of one fish and two mollusc species have been merged into productions of other species because were they recognized as their synonyms (see respective Notes). For this reason these numbers differ from those listed in the Introduction.

Table 3. Number of species and other taxonomic levels* having aquaculture production reported to FAO from 1984 to 1994 for the three major animal groups

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
FISHES											
n of species	73	76	82	84	89	90	91	95	94	101	103
n of other taxa	32	32	35	36	34	36	34	38	37	37	38
Totals	105	108	117	120	123	126	125	133	131	138	141
CRUSTACEANS											
n of species	14	20	20	20	21	21	19	20	19	20	21
n of other taxa	10	10	10	11	11	10	10	10	9	8	10
Totals	24	30	30	31	32	31	29	30	28	28	31
MOLLUSCS											
n of species	33	32	34	35	33	36	38	39	38	40	43
n of other taxa	12	12	12	15	16	16	16	16	15	15	16
Totals	45	44	46	50	49	52	54	55	53	55	59
Total three groups											
n of species	120	128	136	139	143	147	148	154	151	161	167
n of other taxa	54	54	57	62	61	62	60	64	61	60	64
Totals	174	182	193	201	204	209	208	218	212	221	231

*Other taxonomic levels include production data reported not at the species level, ranging from the genus level (e.g., *Rutilus* spp.) to the most generic level inside each group (e.g., Osteichthyes, Crustacea, Mollusca).

Sources: FAO, 1989, 1990, 1991, 1992, 1993, 1994b, 1995d, 1996.

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